AD-A161 375 TIME SERIES ANALYSIS AND MULTIVARIATE STATISTICAL ANALYSIS(U) STANFORD UNIV CA DEPT OF STATISTICS T W ANDERSON SEP 85 ARO-19065 15-MA DAAG29-82-K-0156 1/1

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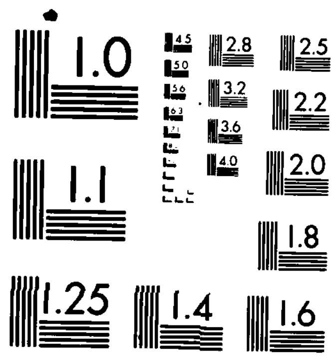

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TIME SERIES ANALYSIS AND MULTIVARIATE STATISTICAL ANALYSIS

FINAL REPORT

Theodore W. Anderson
Principal Investigator

July 1, 1982, to July 31, 1985

September 1985

U. S. Army Research Office
Contract DAAG29-82-K-0156

DEPARTMENT OF STATISTICS

STANFORD UNIVERSITY

STANFORD, CALIFORNIA

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARO 19065.15-MA	2. GOVT ACCESSION NO. N/A	3. RECIPIENT'S CATALOG NUMBER N/A
4. TITLE (and Subtitle) Time Series Analysis and Multivariate Statistical Analysis		5. TYPE OF REPORT & PERIOD COVERED Final Report 1 Jul 82 - 31 Jul 85
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) T. W. Anderson		8. CONTRACT OR GRANT NUMBER(s) DAAG29-82-K-0156
9. PERFORMING ORGANIZATION NAME AND ADDRESS Department of Statistics - Sequoia Hall Stanford University Stanford, CA 94305		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Research Office Post Office Box 12211 Research Triangle Park, NC 27709		12. REPORT DATE September 1985
		13. NUMBER OF PAGES 4 pp.
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

NA

18. SUPPLEMENTARY NOTES

The view, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Time series analysis, multivariate statistical analysis.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The probability of an estimated moving average model being noninvertible was characterized. Generalizations of autocorrelation and partial autocorrelation coefficients are suggested for determining the orders of autoregressive moving average processes. Maximum likelihood estimators and likelihood ratio criteria were derived for a class of elliptically contoured distributions. Zonal polynomials were developed as characteristic vectors of a matrix of polynomials.

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Research was carried out mainly in the areas of time series analysis and multivariate analysis. In the first area emphasis was on statistical inference in autoregressive moving averages (ARMA) models; in the second area emphasis was on elliptically contoured distributions, zonal polynomials, and estimation of covariance matrices.

Maximum likelihood estimates of coefficients in moving average models can yield noninvertible estimated models with positive probability. This probability was characterized and its limit obtained in various cases. To determine the appropriate orders of the autoregressive and moving average parts the autocorrelation and partial autocorrelation coefficients were generalized; a two-way table of calculated values of these coefficients can be used to assign the two orders. It was shown that the determination is consistent. A range of methods based on autoregressive processes were applied to various substantive problems.

Maximum likelihood estimators and likelihood ratio criteria were derived for a class of elliptically contoured distributions; this class is a generalization of the family of normal distributions and serves as a framework for the study of robustness in multivariate analysis. These estimators and criteria have been related to corresponding estimators and criteria for normal distributions. Their distributions for some cases have been characterized. Invariant tests and their properties have been obtained for linear hypotheses; for example, Hotelling's T^2-test is uniformly locally most powerful. Several definitions of spherically symmetric distributions were compared and analyzed.

Zonal polynomials, which are essential to noncentral distributions in multivariate analysis, have been defined here as the characteristic

vectors of a certain matrix. This definition permitted the development of the properties of zonal polynomials by fairly elementary algebraic methods.

The triangular decomposition estimator of a covariance matrix was symmetrized by means of the Haar invariant measure on orthogonal matrices to obtain an estimator that dominates this conventional unbiased estimator. Some other topics investigated were generalizations of Cochran's theorem and related problems of ranks of matrices, use of tensors in the analysis of variance, and goodness-of-fit criteria.

SCIENTIFIC PERSONNEL

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Akimichi Takemura, Ph.D., June 1982

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